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Comparative Studies on Biochemical Profile of *Spirulina platensis* and *Oscillatoria* Sp. on Synthetic Medium and Dairy Effluent

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***Spirulina* and *Oscillatoria* algae were used for the synthesis of protein and pigment in synthetic and dairy effluent. The dairy waste is indeed one of the major sources for pollution. It contains more amount of lactose and milk protein, phosphate, sulphates. The cyanobacteria is very effective treatment of this waste and also grown very fast. The amount of chlorophyll, carotenoid and phycobilin pigments were relatively increase in dairy effluent than synthetic medium.**

Keywords: *Spirulina*, *Oscillatoria*, Dairy Effluents, Pigments.

Micro algae biomass represents a valuable source of nearly all important vitamins, proteins and other essential compounds, which improve the nutritional property (Kumar *et al.,* 2003). The blue green algae, *Spirulina platensis* has been used for hundreds of years as a food source for humans and animals due to the excellent nutritional profile and high carotenoid chlorophyll content. (Bourges *et al.,* 1971). The genus *Oscillatoria* and *Spirulina* comprises many species which are non heterocystous, filamentous organisms. β-carotene are powerful antioxidants and helpful in the prevention of cardiovascular diseases (Gaziano, 1993; Street, 1994) phycocyanin, the blue pigment present in BGA serves as a protein storage unit and as an anti-inflammatory agent (Romay, 1998) and anticancer properties in animal models (Dainippon, 1983, Gonzalez *et al.,* 1999).

The cyanobacterial cultures could also be used to treat various industrial effluents like dairy effluent and reduce the cause of pollution. Whey is an aqueous by product of the dairy industry. The annual worldwide production is over 80 million tones containing over 1 million tones of lactose and 0.2 million tones of milk protein. This material is expensive to store and transport. So we can use the whey for mass cultivation of *Spirulina* and *Oscillatoria* sp. for pigment and protein production. The present study aims at the comparison of the various pigments (Chlorophyll -a, phycocyanin and β-carotene) and protein content of *Spirulina* sp. and *Oscillatoria* sp. grown in synthetic medium and dairy effluent.

MATERIALS AND METHODS

The cultivation of *Spirulina platensis* and *Oscillatoria* sp. were grown in both synthetic medium and dairy effluent. They were incubated at room temperature for 10 days and analysed for protein, pigment contents.

Estimation of total protein content

The total protein content of *Oscillatoria sp.* and *Spirulina platensis* on synthetic medium and dairy effluent was measured by Lowry *et al.,* method.

Estimation of Carotenoid concentration

10ml of homogenous suspension of the algal culture from the synthetic medium and dairy effluent were collected into sterile centrifuge tube

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aseptically. The homogenous cyanobacterial suspension was centrifuged at 5000rpm for 10min. the pellet was washed twice in distilled water. The pellet was then homogenized with 3ml of 85% acetone. The contents were centrifuged at 5000rpm for 5min. the supernatant was collected and made upto 10ml with 85%acetone. The absorbancy was measured at 450nm against the acetone blank for carotenoid estimation. The concentration of Beta – Carotene was calculated from the following formula

$$= \frac{D \times V \times F \times 10}{2500} \text{ mg/ml}$$

where
D = Absorbancy at 450nm
V = Volume of the sample
F = Dilution factor
2500 = Extinction coefficient

Estimation of Chlorophyll A

10ml of the cyanobacterial suspension was centrifuged at 5000 rpm for 10min the pellet was washed twice in distilled water. It was suspended in 4ml of 80% methanol and vortexed thoroughly. The tubes were incubated in a water bath at 60°C for 1hr (preferably in dark) with occasional shaking. The supernatant was collected and made upto 10ml with 80% methanol (to compensate the solvent loss during heating). It was read at 663 nm.

The concentration of Chlorophyll was calculated from the following formula

$$= \frac{A663 \times 12.63 \times \text{Vol. of Sample}}{\text{Vol. of methanol}} \ \mu\text{g/ml}$$

where
12.63 = Correction factor

Estimation of Total Phycobilin content

The algal samples were homogenized with 3ml of phosphate buffer solution. The suspension was repeatedly freeze and thawed and centrifuged at 5000rpm for 5min. the supernatant was collected and the absorbancy was measured at 565, 615 and 625 nm respectively against phosphate buffer blank.

The different phycobilins are calculated by using the formula
phycocyanin (PC)

$$= \frac{A615 - 0.474\ (A625)}{5.34} \text{ mg/ml}$$

Allophycocyanin (APC)

$$= \frac{A625 - 0.208\ (A615)}{5.09} \text{ mg/ml}$$

C – phycoerythrin (PE)

$$= \frac{A565 - 2.41(PC) - 0.849\ (PVC)}{9.62} \text{ mg/ml}$$

RESULTS AND DISCUSSION

There has been a thirst of interest in microalgal metabolites in recent years. This must be quenched off by continuous investigations for the value added products of blue green algae in a cost effective way. In the present work, the protein, various pigments (Chlorophyll a; carotenoids; phycobilins) of the blue green algae, *Oscillatoria* sp. and *Spirulina platensis* in synthetic medium and dairy effluent were studied. The protein concentration and pigment production of *Oscillatoria* sp. and *Spirulina platensis* grown in synthetic medium and dairy effluent was shown in Fig. 1. The protein concentration of *Oscillatoria* sp. and *Spirulina platensis* grown in synthetic medium were 0.19mg/ml and 0.36mg/ml, where as in dairy effluent 0.20mg/ml and 0.38mg/ml respectively. The protein content was found to be increased in the dairy effluent than in the synthetic medium (Fig. 1).

The chlorophyll, carotenoid and phycobilin pigment concentrations of *Oscillatoria* sp. and *Spirulina platensis* also show a relatively increase in pigments when grown in dairy effluent (Figs. 2, 3 & Table 1). The significant increase in all the parameters observed suggest that dairy effluent enhances the growth and has great effect in altering or increasing the physical parameters of cyanobacteria. Kanikasharma *et al.,* (2003) also reported the significant increase of the protein and Chlorophyll a content of cyanobacteria grown in dairy effluent, and also suggested the significance of cyanobacteria in the effluent treatment.

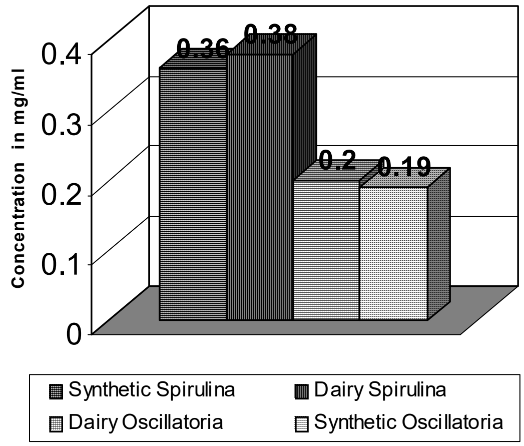

Fig. 1. Protein concentration in Synthetic medium and Diary effluent

The chlorophyll concentration of *Spirulina platensis* was found to be 77.9 mg/ml and 81.1 mg/ml and that of *Oscillatoria* sp. was 76.4mg/ml and 80.2mg/ml when grown in synthetic medium and dairy effluent respectively. Similarly the carotenoid concentration of *S. platensis* was 0.024 mg/ml and 0.04 mg/ml and *Oscillatoria* sp. was 0.021 mg/ml and 0.039 mg/ml respectively.

The phycobilin concentration was also significantly increased when grown in dairy effluent. The allophycocyanin was found to be in increased amount than the other two, phycocyanin and phycoerythrin. *Spirulina platensis* show a very low or no amount of phycocyanin. According to Burja *et al.,* (2002), the variations or increase in the surface area to volume ratio may influence the growth rate, wet weight and pigment production. Several studies were done on the carotenoid, chlorophyll and phycobilin concentration of *Spirulina* (Millie *et al.,* 1990; Tanaka *et al.,* 1974, Krinsky, 1979; Bennett and Bogorad, 1971) and Oscillatoria (Burja *et al.,* 2002; Millie *et al.,* 1990). The use of carotenoid as pigments was well documented and proved to increase the colour of egg yolk and golden fishes (Anderson *et al.,* 1991; Inborr, 1998; Inborr and Lingnell, 1997). The comparison of the carotenoids of the strain of Oscillatoria and Spirulina was evidently given by Askermann *et al.,* (1992); Millie *et al.,* (1990); Tanaka *et al.,* (1974). The carotenoids are considered as photoprotective and also as antioxidative agents (Krinsky, 1979; Palozza and

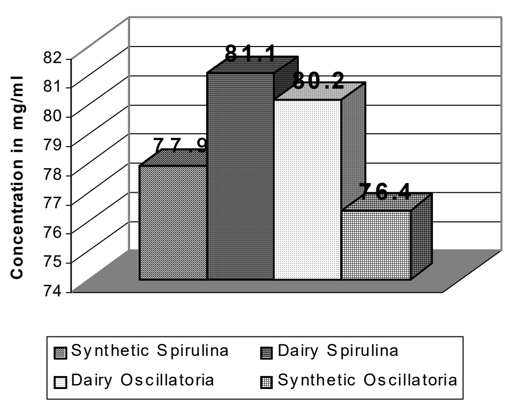

Fig. 2. Chlorophyll concentration in Synthetic medium and Diary effluent

Krinsky, 1992). A significant increase in the production of all pigments like carotenoids and chlorophyll a was reported by Lange *et al.,* (1999) and Michael Lakatos *et al.,* (2001) at the highest solar exposure. Palozza and krinsky, 1992; Bhat and Madyastha, 2000; Romay *et al.,* 1999 reported that the Blue green algae in general contain a significant amount of carotenoids, namely beta carotene, lycopene and lutein. By their quenching action of antioxidative and anti inflammatory properties due to their high phycocyanin content has a wide therapeutic use Burja *et al.,* (2002) reported that the cyanobacterium *Lyngbya majuscule* was found to produce cyclic and linear lipopeptides of the 40 odd natural products isolated so far from this particular species of *Cyanobacteria*, more than half are lipopeptides. These compounds characteristically have potent anticancer and antimicrobial activity (Moore, 1996).

The action of *Cyanobacteria* is very effective in the treatment of industrial effluents. The phosphates, sulphates, proteins and carbohydrates are reduced and uptaken by the cyanobacteria (Manoharan and Subramanian, 1992, 1993); Tam and Wong, (1990); Uma and Subramanian (1990). The blue green algae play an evident role in reducing pollution from dairy industrial effluents, they also produce higher amount of protein and pigment compounds in dairy waste compared to synthetic media.

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